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AMERICAN STATISTICAL ASSOCIATION.

NEW SERIES, No. 44.

DECEMBER, 1898.

CONSIDERATIONS IN GATHERING FORESTRY STATISTICS.*

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The call for statistics regarding our forest resources, their extent, consumption, and duration in connection with the tariff discussions has revealed the fact that we have but little if any reliable information on the subject, and has accentuated the need of more accurate knowledge.

In the expectation that an attempt may be made to secure the necessary funds for the purpose of getting this information, either in connection with the Census or independently, it may be of practical interest to point out what forestry statistics are and what their gathering involves.

Before approaching the subject of this paper I may be allowed to state my conception of the work of a statistician in general, since I have observed that misconceptions, even among so-called statisticians, seem prevalent.

The statistician to my mind is more than an enumerator. If he wishes to fulfill his true function he cannot, as a prominent official statistician once declared that he did, "count hogs, dogs, and logs alike." The sum totals thus obtained would probably be of little practical value. If, as I conceive,

* Presented at the Meeting of the American Statistical Association in Washington, May 27, 1897.

the statistician is not only a recorder of the results of the past progress of development and civilization, but also acts as a guide for future progress, as an auxiliary to the economist and legislator, he must have more than numerical knowledge of the matter which he subjects to statistical inquiry; he must be conversant with its meaning and position in the household of the nation and its relative importance; its relation to other fields and its nature in general. To be sure, facts, and facts only, are the object of the statistician, but facts in relation, concrete facts, which will give a picture of the condition of any one phase of our civilization, of our industrial life, intercourse or development; facts which may serve as a basis for the discovery of the law of progress, which will give us insight into the causes of present conditions and means of judging, if not forecasting, and directing future conditions. His information, in other words, must lend itself to *statical* use.

Hence, in the gathering of these facts, if they are to be useful, the object for which they are to be used cannot entirely be overlooked by the statistician, and his method of investigation and statement will, in part, at least have to be formulated with this object in view to insure adequacy of the results of his inquiry.

There are some facts that can be ascertained by mere enumeration, and the methods of the census-taker suffice for these. There are other facts which are beyond the reach of the census-taker and his methods; facts which require the employment of an expert and special methods.

I claim, then, that in the first place the statistician who proposes to ascertain facts relating to forestry matters must have some knowledge of the forest and its nature, and of the object, relations, and methods of the forest industries; and, secondly, he must be sufficient of a forestry expert to be able to devise methods which will produce adequate results from the inquiry.

It may be well also to point out that the absolute truth can rarely if ever be found. Truth is only relatively true. Almost all statistics, especially when referring to a large field, *are* only approximations to a greater or smaller degree, and in most fields, by the nature of things, even with the best methods, *can* be only approximations. As we will see, forestry statistics, like all crop statistics, are of this class.

The approximations may be closer or less close according to the methods pursued, and here again the object in view will determine the choice of methods. We must make up our mind as to what degree of accuracy and approximation we may be satisfied with before starting our investigation. Thus the statistics which the census statistician gathers to present a picture of our conditions as a nation would never satisfy, and should not attempt to satisfy, the needs of a commercial transaction.

Forestry is the rational use of the soil for wood crops just as agriculture is the rational use of the soil for food crops. Rational use of the soil requires a division of the same and the assignment of different portions to food crops and to wood crops. In the well-ordered State the soils most fit for agriculture are devoted to systematic cultivation of food crops as fields and pastures; but just so should the non-agricultural soils, the *absolute* forest soils, be devoted to the systematic cultivation of wood crops. When such a disposition or distribution and use of soils is accomplished the highest state of civilization from the cultural point of view is reached. Since, then, the statistician, especially the census statistician, has for his final task to measure the state of our civilization, the distribution of farm and forest area forms a proper object of his inquiry.

Wood growth fulfills a twofold function; not only does it supply materials most necessary to civilization, but it forms a condition of the earth's surface, which is known or believed to have a determinative influence on other cultural conditions, namely, those of climate, soil, and waterflow. Especially in

the last two directions the forest cover in certain situations, on hills, slopes, and mountains, exercises a potent influence in preventing erosion of soils, and in regulating the drainage of rain and snow waters, thereby decreasing the excess and frequency of high and low water stages, both in the water channels and the subterranean ground waters.

The forest, therefore, forms a special cultural element aside from the material which it supplies, and hence forestry statistics must have two objects in view, namely, to furnish information regarding the material supplies of the forest resource, and information regarding its conditions with reference to the other mentioned conditions which the forest cover influences or predicates. We may at once distinguish "supply" forests and "protective" forests. As a rule the two functions are or should be exercised simultaneously, but it is possible that there exist, and in reality there do exist, many forest areas which, while protective in an efficient manner, as supplies are of no significance. Hence, the knowledge of the forest area of a country by itself is meaningless, either as far as wood supplies or cultural condition is concerned; its character and conditions and its topographical location must also be known.

To ascertain the area of a forest cover would appear a simple task. Yet even here the indefiniteness of the term "forest" makes it necessary to exercise judgment, and it would be difficult to direct a mere enumerator with some definite rule by which to segregate. To be sure, the whole earth almost is a potential forest, *i. e.*, is capable of supporting and eventually may cover itself with tree growth, but from the point of view of present statistical inquiry the present condition and value of the woodland or its prospective condition and value within the present and perhaps next generation, either as a present or prospective supply forest or as a desirable protective cover, can alone enter into consideration.

It will, then, be necessary for the statistician to have a conception as to what to consider as forest growth, and, furthermore, classification of the area is necessary, based upon topography, soil conditions, kinds composing the wood growth, density and age of the same.

I may stop long enough to try to define what a forest is. The English lexicographers seem to consider large extent and virgin or natural growth, an absence of cultivation, as distinctive attributes to the word "forest," while the word "woodlands" is vaguely and inconsistently defined as the generic term for land covered or interspersed with trees and of *less extent* than a forest, or else land on which "trees are suffered to grow either for fuel or timber" (Webster), accentuating thereby relation to the uses of man.

I believe that etymology, linguistic sense, and actual usage, especially in later times, since the subject of forests and forestry has become prominent, would warrant us in defining more precisely: *woodland* as the general or generic term for land naturally covered with woody growth in contradistinction to land not so covered; *forest* as the restricted or specific term, namely, woodland, whether of natural growth or planted by man, considered in relation to the economic interests of man, and from the standpoint of national economy as an object of man's care; a woodland placed under management for "forest purposes," and, we may also add, exhibiting "forest conditions." These last limitations are important.

By the first restriction we exclude at once those lands covered with trees or woody growth which serve other than forest purposes, such as coffee plantations, orchards which are grown for fruit, roadside plantings and parks which are planted or kept for shade and ornament, windbreaks, consisting of single rows of trees which, although like the other conditions of tree growth mentioned may answer some functions of forest growth, are not primarily intended to fulfill forest purposes, and lack what I have called "forest conditions." These imply a more or less exclusive occupancy

of the soil by arborescent growth, a close stand of trees, as a consequence of which a form of individual tree growth results unlike that produced in the open stand, and a more or less dense shading of the ground which excludes largely the lower vegetation.

By so much as these conditions are deficient by so much does the forest fail to deserve the name and to fulfill its economic functions, namely, as a source of useful material, and as a factor in influencing climatic soil and water conditions.

As an example of a disappointing piece of work in this line we may take the maps of Massachusetts and Connecticut, prepared by the Geological Survey, on which the forest area is noted all in one color. Who knows anything from the economist's point of view of the forest area of the State by looking at this map? Mere waste brush lands which for a generation or more may remain valueless, either as supply or protective forest, are treated the same as any old timber growth, furnishing logs to the mill and cover to the ground. Without classification and additional notes the map conveys to the uninitiated the idea that the State is well provided with valuable forest growth, indeed is superabundantly so provided; and yet we know that there is no timber worth speaking of to be found in these States, that the composition and condition of much of the woodlands does not promise much for the future in this respect, and that, even as a protective cover, they are ineffective. The information thus stated is a snare and a delusion. I do not question the good intention in thus segregating the lands which are not used agriculturally, but the usefulness of the data from the forestry point of view is not apparent.

To enable us to estimate cultural conditions merely it is desirable to know whether the woodland is located on non-agricultural or agricultural soils, on slopes and mountain tops (which to be sure the topographic contour lines allow in part to judge), and the condition of the cover, whether open or

dense, and even whether old or young, and in what stage of development.

From the standpoint of supplies it becomes necessary also to know something about the composition, for a large part of the trees growing in a woodland are weeds,—useless and worse than useless; further the age of valuable supply areas, and the quantity of material either on hand or prospective needs to be known. To be sure no mere topographer and surveyor, however excellent a man, and no mere enumerator, is capable of furnishing such information about a crop whose nature not even those who harvest it understand. It is only a professional forester who can judge the economic value of such a crop and describe its conditions in a manner which will permit a diagnosis of the question of supply or even cultural condition. In the case of agricultural use of the soil or agricultural crops which ripen and are harvested the same season they are put in the ground the matter is much more simple; the opinion of the owner as to the prospective quantity or value or the opinion of any agriculturist can be readily accepted as approximating the truth sufficiently.

In considering a forest crop, especially one in natural condition, such as we have to deal with where forestry, the art of growing useful wood crops, is not yet applied, we must keep in mind that of the many trees growing only a few kinds serve our industrial purposes, the rest, excepting as they may serve as soil cover or firewood, are weeds.

As a result of the method of culling, which our lumbermen have pursued in harvesting the valuable virgin growth, we shall find that large areas, which to the unprofessional eye appear an unbroken forest, contain in reality hardly any kinds or individual trees fit for industrial uses. Worse, by this gradual culling out of the useful kinds, the ground is left to the occupancy of the tree weeds, which must first be removed to give room for a valuable forest crop, just as the forest had to be removed to make room for the agricultural use of the soil. Thus the two States of Massachusetts and

Connecticut, for which the United States Geological Survey maps show one-half or more of their areas under forest, do not contain any considerable areas on which wood useful in the arts is growing. Not only is the number of tree weeds usually in preponderance, but the valuable hardwoods are mostly sprouts from the stump, which, growing rapidly for the first 20 or 30 years, cease to grow early, and rarely attain log size in a reasonable time. Nothing but seedling forest growth will satisfy the demands of our wood industries.

We see, then, that statistics of forest areas, even if we are careful to rule out all mere waste brushlands, which in generations to come will not assume forest aspect, are of little or no use for any practical purposes unless we know also something of their condition. This is true not only from the crop aspect of the forest cover but also from the protective aspect. For whether the forest cover is capable of influencing climatic, soil, or water conditions depends entirely upon its own conditions.

A few scattered trees and shrubs over a surface robbed by fire of the litter and vegetable mould, which is the essential feature of a forest floor, trampled by sheep and cattle either into a compact smooth thrashing floor or into an impalpable dust, can hardly be expected to be of the same value as a dense stand of timber interposing impenetrable shade to the drying influences of the sun, an impenetrable barrier to cold and hot blasts, with a floor of vegetable mould, the accumulation of centuries, which keeps the soil below porous and open, retains the water and gives it up gradually to the lower strata and lower levels instead of turning it into rapid surface drainage. If merely as a soil cover the value of a forest depends upon its condition, how much more so when considered as a crop.

Of all the kinds of wood in which our country abounds the conifers, and especially the pines, are the most useful, the most generally used and the most difficult to do without. So true is it that our civilizations are built of pine and its

congeners that such countries as Brazil and Australia, both heavily wooded, are forced to become large importers of our coniferous article. Two-thirds to three-fourths of all the wood of log size which we use is of this description. Hence, the statistician ought to give special attention to this part of our resource, its present condition and future promise.

If wood alone were our need we might dispense with forestry and forestry statistics; for supplies of wood are, and for a long time will be, plentiful through nature's unaided efforts.

If only hardwoods, so-called, were needed we should still be able to defer our concern regarding supplies, for the reproduction of these accomplishes itself by seed as well as by sprouts from the stump. The chances are, therefore, at least double those of the conifers, which reproduce only, or almost only, by seed. It is coniferous wood of good quality and serviceable size that our civilization is mainly concerned in, and as this is rapidly culled from the virgin forest and under the careless treatment which our woodland areas receive does not reproduce itself as rapidly, while the young growth suffer much more severely from the forest fires than the hardwoods, the attention of the economist and statistician is or should be naturally directed to this important part of the question first, to this most needful and useful forest crop.

There are two considerations in which a forest crop differs from any other kind of crop, and in which forestry, the industry concerned in wood production, differs from any other industry and renders it *sui generis* in its technical and financial as well as economic aspects. These are the time element in the production of the crop and the indeterminateness of the maturity of the crop.

We must repeat again and again that it is not simply trees or wood that the forest grower, the lumberman, and the wood consumer desire, but wood of given qualities; wood of size and fit for industrial uses. To produce the timber of size

from which our lumber is cut at present has taken from 150 to 200 and more years, and even with the best skill in aiding nature's efforts a serviceable pine log may not be expected in less than 75 to 100 years, and *then* we shall have to scale down considerably our requirements as to quality from our present standard. The time to harvest the crop is not a matter determined by the season, as in agricultural crops, but by two variable considerations, namely, technical or financial, either the serviceableness of the size of the log or the profitableness of cutting it, or both. The size when a log is serviceable depends not only on the use to which it is put, but also on the practice of the market and mill, and these influence, with other considerations, the question when it is profitable to cut it. The statistician cannot help considering these matters, for whether the mills are sawing only logs 10, 12 or 14 inches in diameter, as was the practice in the pineries in 1880, or whether they have adapted their machinery and methods to scale down to 5 inches, as is now done in some parts of Maine and elsewhere, must make a difference in his statement of supplies at hand or becoming available.

The question of profitableness in our country has so far been determined only from the standpoint of the harvester, the cost to the logger and mill man, — by no means from the standpoint of the forest owner or wood producer, and much less from the standpoint of national economy. Of the wood standing on an average acre of virgin growth which is being cut for lumber under our present methods, at best not more than 50 per cent of the total wood volume, and usually less than 20 or 25 per cent, is utilized; the balance is waste or left to grow, the waste being due to avoidable and unavoidable causes on account of absence of market for inferior parts, tops, etc., on account of defects, careless felling, uneconomical handling, etc.

Thus an interesting account is given by the Forest Commissioner of Maine with regard to a typical acre of spruce land: —

Original stand, 52 trees of 12 in. and over, . . .	1,360 cub. ft.
214 " of 3-12 in.	1,440 " "
	2,800 cub. ft.
Utilized 36½ per cent in logs hauled, ...	1,020 cub. ft.
which in the mill may furnish between 400 and 500 cub. ft. in the shape of lumber. .	
Wasted 11 per cent in stumps and tops, ...	340
Destroyed in cutting, 17 per cent, ...	480
Blown down, 17 per cent, ...	480
	1,300 cub. ft.
Left to grow, 17 per cent, ...	480 " "
	2,800 cub. ft.

The layman and the average inexpert statistician can hardly realize how much difference the size of the log makes in the output at the mill. Thus in the average mill practice, while from a log thirty inches in diameter 72 per cent may be realized in the lumber, a log of ten inches will yield only 35 per cent of its volume in the shape of lumber, and of a log of five inches diameter, the smallest now cut, three-quarters more goes into the slab and saw-dust pile. A consideration of this kind will forcibly impress the statistician and economist with the fact that whatever small profit the logger may make from the cutting of small trees, it is an enormous loss to the national capital, for the available quantity as well as the value of the accumulated wood crop increases by the mere annual accretions of wood, in geometric, not in arithmetical, ratio, for quite a time.

The lumberman of the present day is not a wood producer; he is merely a harvester,—a miner taking the pay ore, a butcher slaughtering the herd without concern of replenishing it; he is not a breeder, not a forester. What he leaves he leaves simply because it does not pay to take it; not because he expects that it will grow into serviceable material. For reproduction he not only makes no provision, but by his methods he prevents it, and forest fires do their part to aid him.

The small trees left by him, which are not always young trees by any means, but "runts" that have struggled under

the shade of the taller trees, sometimes for a hundred years, grow on after the first logging, and after some time there are again a few trees which have attained a size fit for the saw, and the logger returns for a "second crop," and he talks about the so-called "second growth" as if it were reproduction. Thus he claims, for instance, that the spruce forest in Maine renews itself every 20 years. As a matter of fact in many if not most cases there is no renewal or hardly any; few new trees start to grow, only those left of the first crop as found produced by nature, having been given light, have grown to serviceable size. Reproduction takes place now and then under favorable conditions, but wherever a species is culled from a mixed growth, and most of our woods are so culled, it is only a question of a short time when it is practically exterminated, the shade of the unserviceable trees, the tree weeds that were left preventing or reducing the chance of reproduction.

The logger or lumberman of today is concerned only in the quantity of immediately serviceable log timber. He has hardly yet given a thought to the future. But the economist, and his collaborer the statistician, if not the harvester, must pay attention to the conditions of the growing crop as well as of the grown crop.

The quantities available for present mill use could be closely approximated either by actual measurement or estimate of the standing timber by expert estimators. A really good estimator can come within 10 to 20 per cent of the more exact measurements, and produces invariably an underestimate, for he has usually been employed by purchasers of timber, and for safety's sake he must remain below the truth. If he does his work conscientiously he ascertains, by a few measurements in every new territory he enters, and, preferably, every day he is at work, to keep his eye in training, the quantity produced by an average-sized tree, and then counts the serviceable trees, and by multiplication he arrives at the total for each 40 acres, a convenient area to

handle, making allowance for defects (which is a very variable quantity). It is apparent that such a method, which is the one employed for commercial transactions, would hardly be practicable for mere statistical purposes; the cost of such a canvass, which cannot be less than 2 cents per acre for all timber land, forbids its use over an area counting by millions of acres.

Again we must realize that such statistics as the census maker can gather are not meant for commercial use directly. Approximations only are wanted within a reasonable degree of accuracy, such as the economist and legislator require to form a judgment of general conditions. In the present case we shall have to devise a method of averages applicable over large areas of typical forest growths. Needless to say, these averages must be determined with care by competent experts able to select and recognize types and classify the areas accordingly.

If there is difficulty and need of expert judgment in determining quantity and value of standing merchantable timber which is within the actual vision of the estimator, how much more difficulty must be found, and expert knowledge be needed, to judge the prospective quantity and value of the unperfected crop which is the promise of the future. Here, too, average methods must be devised, based upon the ascertainment of the rate of growth for typical areas. To be sure different degrees of accuracy in the method can be employed according to the greater importance of any or one part of the resource. Thus it would be desirable to ascertain the conditions of our coniferous resource with more precision than of our hardwoods.

This paper is intended to be merely suggestive, preliminary—not exhaustive. We may, therefore, now only briefly summarize the knowledge which we might expect a tolerably satisfactory statistical inquiry into our forest conditions and forest resource to produce as a basis for statical purposes.

1. The area of forest cover, classified according to —
 - (a) location with regard to topography, hydrography, soil conditions, means of transportation, markets;
 - (b) composition, *i. e.*, relative occurrence of merchantable kinds;
 - (c) condition as to density and character of growth and soil cover, age, damage by fire, etc., treatment.
2. The value of the forest resource, both expressed in quantities of available or prospective crop material (the latter based on rate of growth), segregated by kinds and character and the money value as far as ascertainable; also with reference to protective functions and cultural significance.
3. The proprietary conditions; State, communal, institute ownership which promises greater stability as against private ownership; size of parcels owned individually, which predicates manner of treatment.
4. Prices of crops, and cost of production and harvest.
5. The market conditions and statistics of wood-consuming industries.

On this part of the inquiry which concerns itself with the harvest, disposal and use of the forest products, I have not enlarged, for there is little or no difference in the gathering of statistics of these industries from those of other industries, except perhaps that as many of the forest industries are carried on away from centers of production and as a side business in connection with other industries more careful search may be necessary to come nearer to the approximation of the truth. In this direction I believe the methods elaborated in the Eleventh Census with few changes, based on the experience of that census, may answer the purpose.